REMARKS

This communication is a full and timely response to the aforementioned non-final Office Action dated May 2, 2007. By this communication, claims 1-16 are amended, and claims 17-25 are added. Thus, claims 1-25 are pending in the application. Reexamination and reconsideration of the application are requested in view of the foregoing amendments and the following remarks.

I. Amendments to the Specification

The specification has been carefully reviewed and revised in order to correct grammatical and idiomatic informalities in order to aid the Examiner in further consideration of the application. The above editorial amendments to the specification do not add new matter. Accordingly, approval and entry of the amendments to the specification are respectfully requested.

II. Rejections Under 35 U.S.C. §102

Claims 1-16 were rejected under 35 U.S.C. §102(e) as being anticipated by Suzuki et al (U.S. Patent No. 6,707,951, hereinafter "Suzuki"). Applicants respectfully traverse this rejection for the following reasons.

Conventional image processing apparatuses extract halftone-dot regions from image data and perform a smoothing operation on the extracted halftone-dot regions in order to prevent the moiré effect. To extract halftone-dot regions from image data, conventional image processing apparatuses divide the image data into blocks having a prescribed range, and determine whether the characteristics of each block correspond to those of a halftone-dot region.

However, conventional image processing apparatuses suffer from the problem of incorrectly determining characters, for example, as isolated points of a halftone-dot region. In particular, in the case of small-sized characters (e.g., characters that are 5-point or smaller), areas bordered by lines may be detected as white isolated points (see Figure 8, for example, where 12 white isolated points between the box characters are extracted). Furthermore, the dot in the letter "i" or a dot formed by the intersection of lines may be detected as a black isolated point. As a result, a region in which these characters are concentrated may be incorrectly determined to be a halftone-dot region by a conventional image processing

apparatus even if it is not. Furthermore, because smoothing is carried out to such erroneously determined regions, the sharpness of the characters contained therein may become deteriorated.

The present invention provides an apparatus and method that minimize deterioration in output image quality by appropriately distinguishing the attributes of image areas, particularly halftone-dot regions, and performing processing properly suited to such areas.

In particular, as depicted in Figure 1, an embodiment of the present invention[1] provides an image processing apparatus comprising a region determination unit 2, which includes a character determination unit 3 and a halftone-dot determination unit 4. As depicted in Figure 2, the halftone-dot determination unit 4 comprises a dividing unit 40 for dividing image data into large blocks of a prescribed size and further subdividing the large blocks into multiple smaller blocks. For example, as described in paragraphs [0025]-[0026] on pages 9 and 10 of the specification and illustrated in Figure 3, the dividing unit 40 divides the image data into large blocks having a size of M x N pixels, and further divides the large blocks into smaller blocks ① through ⑤ having a size of (i) x (j) pixels.

As depicted in Figure 2, the disclosed embodiment also comprises a large block isolated point calculation unit 46 for calculating the number of isolated points contained in each large block established by the dividing unit 40. In addition, as depicted in Figure 2, the disclosed embodiment also comprises a small block isolated point calculation unit 41-45 for calculating the number of isolated points contained in each small block ① through ⑤ established by the dividing unit 40.

Furthermore, the disclosed embodiment comprises a halftone-dot region determination unit 47-49 for determining whether or not a large block is a halftone-dot region based on the number of isolated points calculated by the large block isolated point calculation unit 46 and the number of the isolated points calculated by the small block isolated point calculation unit 41-45.

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[1] For the convenience of the Examiner and to illustrate support for the features of the present invention, references are made herein to exemplary embodiments described in the specification and the drawings. The references used herein are not intended to limit the claimed invention to the referenced embodiments.

In another exemplary embodiment of the present invention as described in paragraph [0036] on pages 14 and 15 of the specification, for example, the large block isolated point calculation unit 46 calculates the number of isolated points contained in a large block, where the large block is composed of multiple smaller blocks ① through ⑤ based on the small block isolated point totals calculated by the small block isolated point calculation unit 41-45.

By this arrangement, the present invention provides an image processing apparatus and method that minimize erroneous determination of divided and subdivided areas of image data and thereby appropriately determine the attributes of each area within the image data.

Independent claims 1, 6, 11 and 14 recite the above-described features of the present invention. Claims 1 and 6 recite an apparatus that implements the present invention, and claims 11 and 14 recite a method that implements the present invention.

In particular, claim 1 recites an image processing apparatus comprising a dividing unit for dividing image data into large blocks of a prescribed size and further subdividing the large blocks into multiple smaller blocks.

The apparatus of claim 1 also comprises a large block isolated point calculation unit for calculating the number of isolated points contained in each large block established by the dividing unit, and a small block isolated point calculation unit for calculating the number of isolated points contained in each small block established by the dividing unit.

Further, the apparatus of claim 1 comprises a halftone-dot region determination unit for determining whether or not a large block is a halftone-dot region based on the number of isolated points calculated by the large block isolated point calculation unit and the number of the isolated points calculated by the small block isolated point calculation unit.

Claim 6 recites an image processing apparatus comprising a dividing unit for dividing image data into multiple small blocks.

The apparatus of claim 6 also comprises a small block isolated point calculation unit for calculating the number of isolated points contained in each small block established by the dividing unit. In addition, the apparatus of claim 6

comprises a large block isolated point calculation unit for calculating the number of isolated points contained in a large block of the image data, where the large block is composed of multiple smaller blocks based on the small block isolated point totals calculated by the small block isolated point calculation unit.

Furthermore, the apparatus of claim 6 comprises a halftone-dot region determination unit for determining whether or not a large block is a halftone-dot region based on the number of isolated points calculated by the large block isolated point calculation unit and the number of isolated points calculated by the small block isolated point calculation unit.

The methods of claims 11 and 14 recite steps corresponding to the constituent elements of the image processing apparatuses of claims 1 and 6, respectively.

Suzuki discloses a system for detecting isolated points SP in image data by using an isolated point detection filter FD, and determining whether the image data is a halftone dot image according to the number of isolated points SP detected within a predetermined area. As image resolution increases, the size of an isolated point SP becomes larger than the matrix size of the isolated point detection filter FD, which causes the isolated point detection filter FD to become unable to detect the isolated point SP (see Figures 8(A) and 22(B)). To account for this phenomenon, Suzuki discloses that an area discrimination unit 440 reduces the size of the isolated points SP in each block area BE so as to be smaller than the size of the isolated point detection filter FD (see Column 2, lines 48-67; Column 7, lines 37-46; Column 8, lines 29-33; and Figures 4 and 8(B)).

In particular, Suzuki discloses that the area discrimination unit 440 includes a brightness/chroma detection unit 441 which detects the brightness V and chroma W from an input RGB signal. Based on this detection, the brightness/chroma detection unit 441 outputs (i) image data S10 representing the detected brightness V (brightness image data S10) and (ii) image data S11 representing the chroma W (chroma image data S11) (see Column 8, lines 18-28 and Figure 4).

The area discrimination unit 440 also includes a halftone dot image preprocessing unit 442 which, depending on the resolution RS of the brightness image data S10, either reduces the size of the isolated points SP included in the

brightness image data S10 so as to make them smaller than the size of the isolated point detection filter FD, or does not reduce the size of the isolated points SP included in the brightness image data S10 (see Column 2, lines 61-67; Column 7, lines 41-47; Column 8, lines 29-33; Column 9, lines 1-9 and 38-51; and Figures 4 and 8(B)). The halftone dot image preprocessing unit 442 outputs image data S12 including either the size-reduced isolated points SP or the originally-sized isolated points SP of the brightness image data S10.

As depicted in Figure 5, Suzuki discloses that the halftone dot image processing unit 442 includes an image culling processor 4421, a selector 4422 and a resolution detector 4423 (see Column 9, lines 1-5). The image culling processor 4421 performs a culling process on the brightness image data S10 in accordance with the resolution RS of the brightness image data S10. In particular, the image culling processor 4421 reduces the number of pixels by culling specific predetermined pixels from the input brightness image data S10. For example, when the resolution RS is 600 dpi, one-third (1/3) of the pixels are culled from the brightness image data S10. This culling process reduces the number of isolated points included in the brightness image data S10 to a size that is detectable by the isolated point detection filter FD identical to a resolution of 400 dpi (see Column 9, lines 6-16).

Suzuki discloses that the resolution detector 4423 detects the resolution RS of the brightness image data S10, and outputs the detected resolution RS to the selector 4422. Then, based on the detected resolution RS, the selector 4422 selects and outputs either size-reduced (culled) image data S10r or the originally-sized image data S10 as the image data S12 (see Column 9, lines 43-51 and Figure 5).

In rejecting claim 1, the Examiner alleged that the dividing unit, the large block isolated point calculation unit and the small block calculation unit of claim 1 are disclosed by the features of the area discrimination unit 440 of Suzuki. Applicants respectfully submit that the dividing unit, the large block isolated point calculation unit and the small block calculation unit of claim 1 are not disclosed by Suzuki for the following reasons.

First, the image processing apparatus of claim 1 determines whether or not a large block is a halftone-dot region based on two sets of data. These two sets of

data include (1) the calculated number of isolated points contained in each large block, and (2) the calculated number of isolated points contained in each divided small block of the large block. On the other hand, Suzuki discloses that only one set of data is used to determine whether or not there are isolated points SP within the block area BE. In particular, the halftone image discrimination unit 443 of Suzuki merely detects whether there are isolated points SP in one data set, i.e., the block area BE (see Column 8, lines 34-43).

The dividing unit is recited in claim 1 as dividing image data into large blocks of a prescribed size and further subdividing the large blocks into multiple smaller blocks.

By referring to Column 7, lines 28-47, the Examiner appears to interpret the processing of Suzuki of reducing the size of an isolated point SP as corresponding to dividing a large block into multiple smaller blocks. The Applicants respectfully submit that this interpretation is incorrect.

As described above, Suzuki discloses that the size of an isolated point SP is reduced by culling specific predetermined pixels from the input image data S10 (see Column 9, lines 6-16). This culling operation, however, deletes or removes a number of pixels from the brightness image data S10 in order to reduce the size of the isolated point SP. For example, when the resolution detector 4423 detects that the resolution RS of the brightness image data S10 is 600 dpi, the image culling processor 4421 culls (deletes or removes) one-third (1/3) of the pixels from the brightness image data S10 and outputs the remaining two-thirds (2/3) of the pixels of the brightness image data S10 (see Column 9, lines 9-16 and Figure 8). Culling the pixels of the image data S10 does not result in dividing a large block into multiple smaller blocks, as recited in claim 1, because the culling operation of Suzuki results in the removal or deletion of a predetermined number of pixels. In other words, Suzuki discloses that there is only one block, albeit one with a fewer number of pixels. On the other hand, claim 1 recites that large blocks are further subdivided into small blocks, i.e., there are more blocks to be processed in a given unit of the image.

Accordingly, Applicants respectfully submit that Suzuki does not disclose a dividing unit for dividing image data into large blocks of a prescribed size and further subdividing the large blocks into multiple smaller blocks, as recited in claim 1.

Suzuki discloses that a document image is divided into block areas in order to discriminate between different types of document images, such as text images, variable density images and halftone dot images. To determine whether a document image is a halftone dot image, Suzuki discloses that halftone dot image discrimination must be performed on each divided block area (see Column 1, lines 19-26). As shown in Figure 21, image data is divided into a block area BE consisting of a plurality of pixels PX that define the image data.

As described above, Suzuki also discloses that in the area discrimination unit 440, a discrimination is performed on each block to determine whether or not the block area BE is a halftone dot image (see Column 7, lines 29-31).

However, in contrast to claim 1, the area discrimination unit 440 of Suzuki does not further divide the block area BE into multiple smaller blocks. The block area BE of Suzuki can be considered to correspond to a large block that is divided from the image data by the dividing unit of claim 1. However, Suzuki does not disclose any further division of the image data into blocks beyond that of dividing the image data into a block area BE.

Suzuki discloses that after the image data is divided into a block area BE, isolated points within the block are detected by using the isolated point detection filter FD. As shown in Figure 21 of Suzuki, the isolated point detection filter FD sequentially scans each pixel starting from the upper left pixel of the block area BE in order to detect any isolated points SP within the block area BE (see Column 1, lines 34-44; Column 7, lines 36-41; Column 9, line 52 to Column 10, line 18; and Figure 9). Accordingly, the only division performed by Suzuki is the operation of dividing the image data into the block area BE.

If the Examiner considers the large block of claim 1 as corresponding to the block area BE of Suzuki, then Suzuki does not disclose a division unit for dividing the block area BE into multiple smaller blocks, as recited in claim 1. This is because the only sub-division of the block area BE is each pixel PX contained in the original image data. However, pixels PX contained in the original image data cannot be

considered to correspond to the small blocks as recited in claim 1, because the area discrimination unit 440 of Suzuki does not actually divide the image data into pixels PX. In other words, the pixels PX contained in the block area BE, as sub-divisions of the block area BE, existed before the area discrimination unit 440 divides the image data into the block area BE.

Therefore, the area discrimination unit 440 of Suzuki does not disclose a division unit for further subdividing a large block into multiple small blocks, as recited in claim 1.

Similarly, if the Examiner was to consider the block area BE of Suzuki as corresponding to one of the small blocks recited in claim 1, then Suzuki does not disclose dividing the image data into large blocks from which the multiple small blocks are subdivided, as recited in claim 1. This is because the block area BE is the only disclosed division in Suzuki, and the block area BE is a division of the image data. Therefore, if the image data is divided to obtain the block area BE of Suzuki, the image data itself would correspond to the large blocks as recited in claim 1. However, claim 1 recites the dividing unit as dividing the *image data* into large blocks.

Accordingly, if the Examiner was to consider the block area BE as corresponding to one of the small blocks as recited in claim 1, then Suzuki does not disclose dividing the image data into large blocks, as recited in claim 1, because the image data of Suzuki is disclosed as being divided only once, i.e., into the block area BE.

Accordingly, Applicants respectfully submit that Suzuki does not disclose a dividing unit for dividing image data into large blocks of a prescribed size and further subdividing the large blocks into multiple smaller blocks, as recited in claim 1.

Because Suzuki does not disclose both a large block and multiple small blocks contained in the large block, Suzuki cannot disclose both the large block isolated point calculation unit and the small block calculation unit of claim 1. This is because Suzuki discloses that the number of isolated points within the block area BE is determined. However, as demonstrated above, the block area BE cannot correspond to both a large block and multiple small blocks contained in the large block, as recited in claim 1.

Therefore, Suzuki does not disclose (1) a large block isolated point calculation unit for calculating the number of isolated points contained in each large block established by the dividing unit, and (2) a small block isolated point calculation unit for calculating the number of isolated points contained in each small block established by the dividing unit, as recited in claim 1.

In rejecting claim 1, the Examiner referred to Column 7, lines 41-47 and Column 10, lines 19-26 of Suzuki in asserting that Suzuki discloses the small block isolated point calculation unit of claim 1. This assertion, however, is incorrect. Column 7, lines 41-47 of Suzuki disclose that processing is executed on the brightness image data S10 to reduce the size of the isolated point SP included in the brightness image data S10 so as to be smaller than the size of the isolated point detection filter FD, in accordance with the image data resolution, and that the processed image data are subjected to filtering by the isolated point detection filter FD. As described above, reducing the size of an isolated point by culling specific predetermined pixels does not result in dividing the image data into large blocks or further subdividing large blocks into multiple smaller blocks. Furthermore, the filtering process of Suzuki is performed by sequentially scanning each pixel of the block area BE, not by calculating isolated points contained in a large block and calculating isolated points contained in each small block contained in the large block, as recited in claim 1.

Column 10, lines 19-26 of Suzuki disclose that the halftone dot image discrimination unit 443 of Suzuki (see Figures 4 and 5) includes a white isolated point detector 4431 and a black isolated point detector 4432 for respectively detecting white and black isolated points in the image data S12 output from the halftone dot preprocessing unit 442. The white isolated point detector 4431 detects white isolated points SP in the image data S12 by using a white isolated filter FDW, and the black isolated point detector 4432 detects black isolated points in the image data S12 by using a black isolated filter FDK (see Column 9, line 57 to Column 10, line 18). The white isolated point counter 4433 counts the number of detected white isolated points SP, and the black isolated point counter 4434 counts the detected number of black isolated points SP. Then, a halftone dot image discriminator 4435 compares the number of counted isolated points with a threshold value, which is set

based on the resolution RS of the brightness image data S10, and determines that the block area BE is a halftone dot area when the aggregate count value exceeds the threshold value (see Column 10, lines 19-37, and Figures 5 and 10).

Contrary to the Examiner's assertion, the above-referenced disclosure of Suzuki does not disclose a small block isolated point calculation unit for calculating the number of isolated points contained in each small block established by the dividing unit, as recited in claim 1.

First, as demonstrated above, Suzuki does not disclose that the image data is divided into a large block and that the large block is further subdivided into multiple smaller blocks. Accordingly, Suzuki does not disclose that both (1) isolated points contained in a divided large block of the image data are calculated, and (2) isolated points contained in subdivided small blocks of the large block are calculated.

Second, the detection of white isolated points and black isolated points by the white and black isolated point counters 4433, 4434 of Suzuki does not pertain to calculating isolated points contained in each small block divided from a large block. This is because the detection of the white and black isolated points is performed separately by using a different filter FDW, FDK (see Column 9, lines 57-67). Furthermore, the detection of white and black isolated points of Suzuki is performed over the entire block area BE, not in each small block established by a dividing unit. In addition, Suzuki does not disclose that the image data is divided into a section containing white isolated points and a section containing black isolated points. Instead, the separate filtering processes for detecting both white and black isolated points are performed over the entire block area BE, not for isolated points contained in each small block divided from a large block, as recited in claim 1.

Accordingly, Suzuki does not disclose both (1) a large block isolated point calculation unit for calculating the number of isolated points contained in each large block established by the dividing unit, and (2) a small block isolated point calculation unit for calculating the number of isolated points contained in each small block established by the dividing unit, as recited in claim 1.

Because Suzuki does not disclose the dividing unit, the large block isolated point calculation unit and the small block isolated point calculation unit of claim 1, Suzuki accordingly cannot disclose a halftone-dot region determination unit for

determining whether or not a large block is a halftone-dot region based on the number of isolated points calculated by the large block isolated point calculation unit ***and*** the number of the isolated points calculated by the small block isolated point calculation unit, as recited in claim 1.

Therefore, for at least the foregoing reasons, Applicants respectfully submit that claim 1 is not anticipated by Suzuki, since Suzuki does not disclose each and every limitation of claim 1.

Similarly, Applicants respectfully submit that Suzuki does not disclose or suggest each and every limitation of the method of claim 11, which recites method steps corresponding to the constituent elements of the apparatus of claim 1.

Furthermore, for at least the foregoing reasons, Applicants respectfully submit that Suzuki also does not disclose each and every limitation of claim 6. In particular, Suzuki does not disclose a large block isolated point calculation unit for calculating the number of isolated points contained in a large block of the image data, where the large block is composed of multiple smaller blocks based on the small block isolated point totals calculated by the small block isolated point calculation unit, as recited in claim 6. Moreover, Suzuki does not disclose a halftone-dot region determination unit for determining whether or not a large block is a halftone-dot region based on the number of isolated points calculated by the large block isolated point calculation unit ***and*** the number of isolated points calculated by the small block isolated point calculation unit, as recited in claim 6.

Similarly, Applicants respectfully submit that Suzuki does not disclose or suggest each and every limitation of the method of claim 14, which recites method steps corresponding to the constituent elements of the apparatus of claim 6.

Therefore, for at least the foregoing reasons, Applicants respectfully submit that claims 1, 6, 11 and 14 are not anticipated by Suzuki, because Suzuki does not disclose each and every limitation of claims 1, 6, 11 and 14.

Furthermore, in view of the clear distinctions presented above, Applicants respectfully submit that one skilled in the art would not have been motivated to modify Suzuki in such a manner as to result in, or otherwise render obvious, the inventions of claims 1, 6, 11 and 14.

Consequently, Applicants respectfully submit that claims 1, 6, 11 and 14, as well as claims 2-5, 7-10, 12, 13 and 15-25 which depend therefrom, are clearly patentable over the reference applied by the Examiner.

III. Conclusion

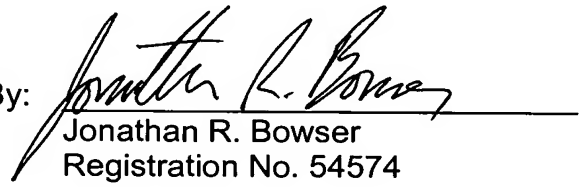
In view of the foregoing amendments and remarks, it is respectfully submitted that the present application is clearly in condition for allowance. Accordingly, Applicants request a favorable examination and consideration of the instant application.

If, after reviewing this Amendment, the Examiner feels there are any issues remaining which must be resolved before the application can be passed to issue, the Examiner is respectfully requested to contact the undersigned by telephone in order to resolve such issues.

Respectfully submitted,

BUCHANAN INGERSOLL & ROONEY PC

Date: October 1, 2007

By: 

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